

Biliary duct injuries in the laparoscopic era: our experience

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SUMMARY: Biliary duct injuries in the laparoscopic era: our experience.

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Aim. The main aim of our study is to evaluate the incidence, the type, the causes and the therapy of biliary duct injuries which occurred after the video laparoscopic cholecystectomies performed in our Department during the period from 1990 to 2012.

Patients and methods. A retrospective analysis of 1186 VLC has been made in our Department from March 1990 to June 2012. Before

the cholecystectomy all patient were evaluated with trans abdominal echography. Beyond the incidence of BDI was evaluated damaging mechanism, etiology, therapy and time of diagnosis.

Results. From 1990 to 2012 a total of 9 BDIs occurred, with an incidence of 0,75%. Out of 9 patients 4 had major lesions and 5 had minor lesions; the most common BDI was Strasberg A (45%), the most common etiology was the presence of anatomical variations. In four cases the diagnosis has been intraoperative, in five cases has been postoperative.

Conclusions. Our clinical experience shows that the main cause of BDI are the surgeon experience and the bile ducts anatomical variation.

KEY WORDS: Bile duct injuries - Laparoscopic cholecystectomy - Bile duct anomalies.

Introduction

The bile duct injuries (BDI) are any injuries that affect the intrahepatic or extrahepatic biliary ducts and become clinically evident. They are an important problem in gastrointestinal surgery. They are most frequently caused by laparoscopic cholecystectomy, which is one of the commonest surgical procedures in the world (1), even if they can be caused by other operations performed on other organs such as gastric resection, hepatic resection and liver transplantation, pancreatic resections, biliary-enteric anastomoses, portacaval shunts, lymphadenectomy and other procedures within the hepato-duodenal ligament (2, 3).

After the introduction of laparoscopic cholecystectomy (LC), the rate of BDI was reported to be significantly higher than in previous investigations concerning open cholecystectomy (4-9). The highest rates were re-

ported in the early 1990s when LC was introduced, suggesting a learning curve effect (10-12). BDI during laparoscopy is twice more frequent than injuries during an open procedure (0,3% open vs. 0,6% laparoscopic) (13). The prognosis is directly related to the patient's underlying conditions, as well as the time elapsed between the lesion and its identification and treatment, which is basically the reconstruction of the biliary path (14). The choice of the appropriate treatment for BDI is very important. Initially, endoscopic treatment is recommended in patients with IBDI. When endoscopic techniques are not effective, different surgical reconstructions are performed. The goal of surgical treatment is reconstruction to allow good bile flow to the alimentary tract. In order to achieve this goal, many techniques are used (15).

Patients and methods

A retrospective analysis of the 1186 patients who underwent to VLC from March 1990 to June 2012, in the Department of General, Geriatric, Oncologic Surgery and Advanced Technologies, University of Naples, has been performed to identify the biliary ducts injuries which occurred as a complication of the laparoscopic

cholecystectomy (16,17). Before the cholecystectomy all patient were evaluated with transabdominal echography. ERCP was performed in 43 cases for the clinical symptoms, increase cholestasis enzyme or for the dilatation of the main bile duct, 28 of them have been undergone to endoscopic sphincterotomy. Cholangiography was performed in 18 cases, and the intraoperative cholangiography was performed in 33 cases. The conversion rate was 2,9% (35 cases). In 25 cases the conversion was performed because of viscerovisceral adhesions, in 6 cases for hidden bleeding, in 4 cases for technical reasons. In all the cases was applied the critical view of safety by Strasberg to prevent the biliary duct injury. Has been evaluated the total incidence of BDI in our Department and the incidence of each of the three periods of the laparoscopic cholecystectomy learning curve (the first period from 1990 to 1992; the second period from 1992 to 1995 and the last period from 1995 to 2012) in order to understand how much important is the experience of the surgeon in determining a BDI. BDI was assessed according to: Strasberg's classification, damaging mechanism, etiology, therapy and time of diagnosis (intraoperative or postoperative). They were also grouped into major and minor lesions.

Results

From March 1990 to June 2012 9 BDIs occurred, with an incidence of 0,75%. During the first period of leaning curve (1990-1992) the incidence was higher (0,8%); during the second period (1992-1995) there was a decrease (0,3-0,4%); in the third period the incidence of BDI increased again (0,6%). According to the Strasberg's classification the most common BDI was Strasberg A (45%), then Strasberg D (33%), and finally Strasberg E2 (22%). 3 BDIs occurred for an anatomical variation, 2 lesions for dislocation of the clip, 2 lesions occurred for the misidentification of main bile duct because of the excessive traction on the Hartman's pouch, one lesion occurred because of the tenacious adhesions. In four cases the diagnosis was done intraoperatively, in five cases postoperatively.

5 BDIs (55%) were minor lesions (Tab. 1):

1. The first lesion occurred with biliary leakage from the cystic duct stump through the dislocation of the clip. It was a Strasberg A lesion. The patient underwent to a video-laparoscopic exploration and was treated

with placement of transcystic Nélaton probe.

2. The second lesion was Strasberg A type lesion. The patient had a clip dislocation from the cystic duct stump and a biliary leakage from gallbladder bed. During the reintervention the main bile duct was isolated and was find the cystic duct stump, about 1,5 cm of length, which was sutured. Finally the gallbladder bed was coagulated.
 3. The third patient had an aberrant right hepatic duct section; it was a Strasberg A lesion. The lesion occurred with a biliary leakage. Because of the duct had a small diameter, it wasn't possible to place a Kehr's T tube, so the duct was closed.
 4. The fourth lesion occurred because of there were chronic cholecystitis which caused the strong adhesion between the gallbladder and the main bile duct. Whereby after some attempts to separate the gallbladder from the liver, it was decided to convert in laparotomic access. After the detachment of the gallbladder from the liver, appeared the main bile duct lesion, which was treated with Vicryl 3-0 simple interrupted sutures and the placement of Kehr's T tube.
 5. The last minor lesion was an aberrant IV segment posterior right hepatic duct section. The lesion was find intraoperatively and was treated with the suture of the duct and the placement of a Subhepatic drainage.
- 4 BDIs were major lesions (Tab. 2):

1. The first major lesion was a right hepatic duct partial section, a Strasberg D type lesion, that occurred with a biliary leakage. The patient was treated with the suture of the lesion and the placement of an endoprosthesis.
2. The second major lesion was a main bile duct classical lesion, a Strasberg E2 type lesion. The first day the patient underwent a bi-ductal jejunostomy. In the 35th day the patient died because of emocoagulative complication.
3. The third lesion was a main bile duct total section, a Strasberg E2 Type lesion. During the first day the patient had biliary leakage from subhepatic drainage. Whereby the patient underwent to ERCP with the

TABLE 1 - MINOR LESIONS.

Patient	Damaging mechanism	Type of lesion According to Strasberg's Classification	Diagnosis	Treatment
1	Clip dislocation	A	Postoperative	Laparoscopic placement of transcystic Nélaton probe
2	Clip dislocation	A	Postoperative	Cystic duct suture
3	Aberrant right hepatic duct transection	A	Postoperative	Aberrant duct suture
4	Adhesiolysis	D	Intraoperative	Simple interrupted sutures and Kehr's T tube
5	Aberrant right hepatic duct transection	A	Postoperative	Aberrant duct suture

TABLE 2 - MAJOR LESIONS.

Patient	Damaging mechanism	Type of lesion According to Strasberg's Classification	Diagnosis	Treatment
1	Cauterization	D	Intraoperative	Simple interrupted sutures and Kehr's T tube
2	Classic injury	E2	Postoperative	Biductal jejunostomy
3	Classic injury	E2	Postoperative	End-to-end choledolo-choledocial anasthomosis
4	Anatomical variation	D	Intraoperative	Simple interrupted sutures and Kehr's T tube

placement of a trans papillary stent. During the next days the biliary leakage increased so in the 7th day a PTC was done which showed the main bile duct total section, under the biforcation. On the postoperative 8th day the patient underwent to main bile duct end-to-end anastomosis, with the placement of Kehr's T tube, which was removed after 40 days. After one year and a half, because of recurrent cholangitis, the trans papillary stent was removed and replaced with a new one.

- The last major lesion was a right hepatic duct lesion in a patient with a rare extra hepatic bile ducts anatomical variation. It was a Strasberg D type lesion. The cholecystectomy was converted to laparotomic access because it was impossible to find the cystic duct that was too short. It was performed the IOC, which showed a partial section of the right hepatic duct and a rare anatomical variation: the main bile duct was very short, the right hepatic duct was very long and it was connected with a short left hepatic duct, the cystic duct was absent whereby the gallbladder was very close to the right hepatic duct. The section was treated with simple interrupted sutures and the placement of Kehr's T tube.

Discussion

The aim of the present study was to investigate the incidence and management of Biliary ducts injury during VLC. Early reports on LC showed a high incidence of BDI compared to OC (18-20). The high incidence of BDI is strongly associated with the learning curve of the surgical community. For LC, the Southern Surgeons Club documented a 2.2% incidence of BDI for the first 13 cases performed by every surgeon, whereas for the subsequent patients, the incidence decreased to 0.1% (21). Nevertheless, the introduction of LC created the phenomenon of the learning curve, which in fact, only represents the collective and synchronized gain of experience with a new surgical technique. Therefore, a temporary increase of well-known biliary complications could have been expected (22).

The incidence of BDI in our study (0,75%) is a lit-

tle higher than the incidence of other studies (18, 22). During the first period of learning curve that goes from 1990 to 1992 the incidence it is about 0,8%, because of the poor experience of the surgeons, and this trend is confirmed by some other studies (20, 22). During the second period from 1992 to 1995 the incidence decreased until 0,3% because of the higher experience of the surgeons and the minor number of difficult cholecystectomy treated with the laparoscopic technique. The effect of the learning curve was still considerable, because more than 60% of BDIs were caused by surgeons who performed less than 50 LCs (23). During the third period from 1995 to nowadays the incidence grows again until 0,6%; this rising trend of the last period is due to two reasons: The first reason is the greater confidence of the surgeon in the laparoscopic technique, whereby are treated also the difficult cases (acute inflammation, shrunken gallbladder) with an increased risk for biliary lesions during dissection. The second reason depends by the high number of BDI which occurred for anatomical variation: indeed during the last period 3 on the 4 BDI which occurred were due to anatomical variations.

Being beyond the collective learning curve, about half of all BDIs are now caused by trained laparoscopic surgeons, perhaps because they tend to operate on more difficult patients (22). Therefore, it can be concluded that factors other than the learning curve may influence the BDI rate during LC.: the acute or chronic inflammation, adhesions, patient obesity, fat within the hepato-duodenal ligament, bad exposure of the Calot's triangle, and blind-fold coagulation especially near the clips; however according to our experience anatomical anomalies of the bile ducts significantly increase the risk of IBDI (5, 24, 25).

In our clinical experience the most common lesion is the Strasberg A type lesion, a minor lesion which occurred with biliary leakage from the cystic duct or from an aberrant hepatic duct. In other studies the most common lesion is the Strasberg E2 (26), which represent the less frequent lesion in our series. This difference can be explained by the high number of lesions due to anatomical variation and especially to aberrant hepatic duct.

In our study, out of the 9 patients, 4 (45%) were timely diagnosed and underwent an immediate repair. This

number is higher than that reported in the literature (27, 28). 5 cases were diagnosed postoperatively. All of them presented with biliary leakage from the sub hepatic drainage. The Strasberg type A lesions were treated with the suture of the aberrant or the cystic duct. The Strasberg D type lesion were fixed with simple interrupted sutures and the placement of Kehr's T tube. One Strasberg type E2 lesion was treated with end-to-end anastomosis of the common bile duct and the other type E2 lesions were treated with biductal jejunostomy.

Conclusion

Our clinical experience shows the most important causes of the BDIs. The first important factor is the sur-

geon experience, which is demonstrated by the trend of incidence from 1990 to 2012. The second factor is the presence of anatomical variations of bile ducts, that usually are not so important as in our study. This factor represents the main reason of the high incidence of BDI in our study, and changes the usual pattern of the lesion as shown by the high number of Strasberg A type lesion and the low number of Strasberg E2 type lesion. In addition from our series it should be noted that the most cases are now detected intraoperatively and immediately repaired either laparoscopically or by conversion to open surgery.

For this reason if a biliary injury is suspected during dissection, the surgeon should perform an intra-operative cholangiography and not hesitate to convert to open surgery.

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